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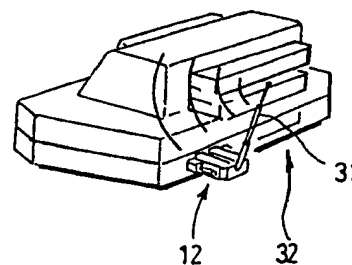
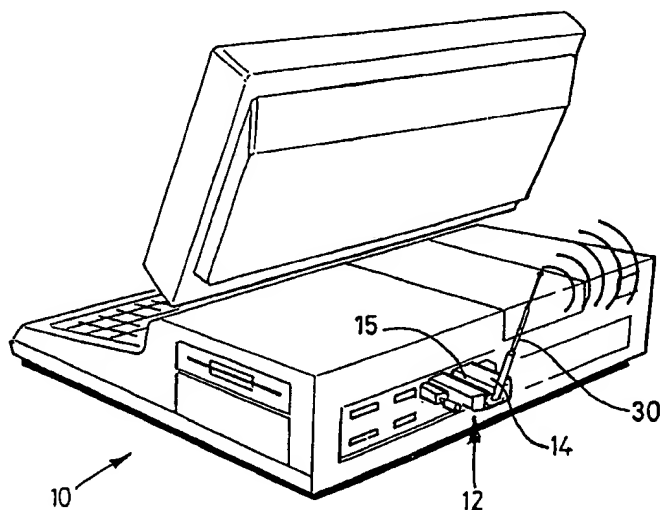
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: COMPUTER CONNECTORS



## (57) Abstract

Method and apparatus are described for inter-connecting a computer and computer peripheral without the need for cabling. Instead, connector plugs (12) for the respective interface ports are provided, each plug including a short range radio receiver adapted to receive and transmit signals to another such plug, to establish a data highway between the computer and a peripheral unit. A telescopic aerial (30) mounted on a swivel base may be provided together with a signal strength display (42). In order to reduce the protrusion from a computer or peripheral unit, the housing may be in two parts (46 and 48) which are hinged to permit part of the housing to be folded flat against the rear of the housing of the computer or peripheral unit. Power for the inter-connection devices is derived from the host computer or host peripheral unit.

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- 1 -

Title      Computer ConnectorsField of the invention

This invention relates to a method of and device for effecting an inter-connection between a computer and a second item of equipment which operates in conjunction with the computer. The second item of equipment may, for example, be constituted by a printer, a plotter, a modem, a computer-controlled machine or another computer. Such a second item of equipment is for convenience and without limitation referred to hereinafter as a peripheral unit.

Background to the invention

Most personal computers, such as IBM personal computers and compatible machines produced by other manufacturers, have one or more general interface ports for enabling inter-connection of the computer with one or more peripheral units. Conventionally, these ports are in the form of an RS-232C bi-directional serial interface and/or a Centronics parallel output interface. Very commonly, the connector socket for either form of interface is a so-called Canon-D fitting of any one of a number of types.

The interface port is generally used to inter-connect the computer with a peripheral unit such as a printer, plotter or the like, as hereinbefore mentioned, which may be relatively close by or may be elsewhere in the premises where the computer is installed. Conventionally, the computer and the peripheral unit, which is equipped with

- 2 -

one or more interface ports in like manner to the computer, are inter-connected through a connector lead, consisting of two connector plugs, e.g. two Canon-D fittings, joined by a length of connecting cable.

#### The invention

According to one aspect of the present invention, there is provided a method of inter-connecting a computer and a peripheral unit each equipped with interface ports, according to which inter-connection is established by means of two connector plugs for the respective interface ports, each plug being incorporated in a housing which also accommodates a short range radio transceiver.

According to another aspect of the invention, therefore, there is provided an inter-connection device for the interface port of a computer and/or peripheral unit, comprising a connector plug incorporated in a housing which also accommodates a short range radio transceiver.

In existing practice, unless the computer and the peripheral unit are very close together, the connecting cable of the conventional connector lead has to be trailed across one or more rooms, thus posing an accident hazard, or to avoid this it has to be laid under the floor, or in ducting or the like, at considerable expense and inconvenience and possible loss of adaptability. Moreover, the trend towards smaller and more portable personal computers, intended to be moved about and possibly taken out of the premises, is incompatible with the more permanent type of inter-connecting cabling. All the aforesaid problems are substantially overcome by the method and device in accordance with the invention.

- 3 -

The invention is readily realisable in practice using current short range radio transceiver technology, which can be accommodated in a housing only slightly longer than the conventional casing of a Canon-D type connector fitting. Thus, the radio transceiver housing can have the same dimensions in the plane of the interface as a conventional connector socket, but is relatively elongated in the dimension normal to the plane of the interface.

One existing kind of short range radio transceiver system which is suitable is known as CT2, which is defined in British Standard BS6833. This is basically a voice transmission system which allows for up to forty pairs of transceivers each to have point-to-point inter-connection within a 100 metres diameter zone, each inter-connection using a separate frequency channel. When a transceiver is required to initiate a radio link to another transceiver, it searches for an unused frequency channel, possesses the channel (assuming one to be available), starts up a point-to-point data transmission, and releases the channel when a link is no longer required. An established CT2 link carries point-to-point data at a rate of 32 kbit/sec, bi-directional.

The invention is applicable to any computer and peripheral unit inter-connection where the computer and the peripheral unit are self powered, as is usually the case. However, the inter-connection device preferably derives the power which it itself requires for operation through the pins of the connector plug which cooperate with the interface port of the computer or peripheral unit. Alternatively, however, for example if the computer or peripheral unit incorporates a battery power supply

- 4 -

instead of being powered from the mains supply, then the inter-connection device may also have its own internal power supply.

The inter-connection device is preferably adapted to interface with a parallel uni-directional port or a bi-directional serial port on the computer or peripheral unit. Selection between the two types may be carried out automatically at the interface, or a two-position switch may be provided on the housing of the inter-connection device.

In the case of a serial bi-directional port on the computer or peripheral unit, the inter-connection device is most desirably adapted to determine the speed, i.e. bit rate, of the port automatically.

Thus, the inter-connection device most preferably incorporates a processor and an associated configuration memory for capturing and storing information relating to the configuration and use of the device, the data stored including the speed at which a serial output port link was last used or set up to be used. A suitable memory will be of the non-volatile type, such as an EEPROM.

While reference has been made heretofore to a CT2 short range radio system, any convenient FDMA radio system may be employed, wherein one channel is occupied per active link.

Data transfer may be "frequency division duplex" (also known as "ping-pong"), as is the case with the CT2 system.

- 5 -

It is clearly important to practical realisation of the invention that the established radio link between computer and peripheral unit transfers data accurately. Normally, no provision is made in personal computers or peripheral units to deal with non-accurate data transfer, because it is to be assumed that none is necessary. However, the radio link of this invention must offer accurate data transfer in spite of errors introduced into a data stream by the radio channel itself. For this reason, data packetisation and error handling are important in the inter-connection device of this invention.

Thus, at each inter-connection device in the transmission mode, data is split into blocks, and for each block a checksum is computed and transmitted after transmission of each data block has been completed. The checksum can enable the other inter-connection device, in the receiving mode, to detect errors, discard bad data, and possibly request retransmission. Alternatively, the checksum may enable the receiving device to detect and correct errors, so that retransmission is rendered unnecessary when appropriate.

It is to be noted that the invention does not require the two inter-connecting devices at the ends of a radio link to be set up in the same way with respect to line speed and serial/parallel mode. There is thus much greater flexibility of inter-connection than with a conventional connector lead.

In practice, a problem can arise in that the inter-connecting device of the invention will almost invariably be fitted at the rear of a computer or peripheral unit, which is a region of high electrical noise and of radio



- 6 -

frequency shadowing.

According therefore to a further aspect of the present invention, there is provided an inter-connection device adapted to plug into the interface port of a computer unit or computer peripheral unit, said device incorporating a radio transceiver for enabling data transfer between two units by radio link, wherein said device is provided for its radio transceiver with an external telescopic antenna which can be adjusted on its mounting to extend in a chosen orientation relative to said housing of the inter-connecting device.

For maximum versatility the inter-connecting device may also be provided with an internal antenna.

According to a preferred feature of the invention the radio may have associated therewith signal strength indicator which may include an LED display visible from the outside of the housing, for indicating the received radio signal strength.

Although the inter-connecting device proposed by the invention will generally not protrude from the rear of a computer or peripheral unit a great deal more than a standard conventional Canon-D type fitting or analogous socket connector, nevertheless this protrusion may be disadvantageous, especially apparent in the case of small computers and peripheral units and, for example if it is wished to push the unit back as far as possible towards a wall or other fixture.

According therefore to another aspect of the present invention there is provided an inter-connection device

- 7 -

adapted to plug into the interface port of a computer unit or computer peripheral unit, said device incorporating a radio transceiver for enabling transfer of data between two units by a radio link, wherein the inter-connection device has a housing formed in two relatively hingeable parts, one part of small dimensions comprising a connector socket for plugging into the interface port and the other part of larger dimensions accommodating the transceiver.

The two parts of such a housing preferably hinge from an in-line condition (maximum protrusion from the computer or peripheral unit to an L-formation condition (minimum protrusion)) with the major part of the housing folded substantially flat against the unit.

An ability to hinge through as much as 180 degrees is advantageous, as the interface ports of personal computers and peripherals are conventionally arranged in any one of four different orientations, and the inter-connecting device is therefore preferably adapted to fold into an L-formation in either direction.

#### Description of embodiment

The invention is exemplified in the following description, making reference to the accompanying drawings, in which:-

Figure 1 diagrammatically shows a personal computer linked by radio to a peripheral unit by means of plug-in inter-connecting devices;

Figure 2 is a block circuit diagram appertaining to either one of the inter-connecting devices;

- 8 -

Figure 3 is similar to Figure 1 but the inter-connecting devices each employ a telescoping external antenna;

Figure 4 is a modified version of the block circuit diagram of Figure 2;

Figure 5 shows a telescoping external antenna and signal strength indicator of the modified inter-connecting device as employed in Figure 3;

Figure 6 diagrammatically shows a personal computer peripheral radio link in which the plug-in inter-connecting devices have hinging housings; and

Figure 7 shows in more detail the hinged housing of the inter-connecting devices shown in Figure 6.

Referring to the drawings, a personal computer 10 has a general purpose interface port which may provide serial, bi-directional or parallel output, into which is plugged an inter-connecting device 12.

The device 12 comprises a housing 14 resembling that of a Canon-D type fitting, but which is slightly longer in the direction normal to the plane of the interface. In addition to a connector plug 16 which engages into the computer interface port in the conventional manner, the housing 14 accommodates a printed circuit board carrying a processor and associated configuration memory 18, an interface input/output circuit 20 with associated serial/parallel selection switch 22, a data packetisation and error handling circuit 24, a channel set-up and data flow

- 9 -

control circuit 26, a short range radio transceiver circuit 28 of the FDMA type and an antenna 30, which as shown may protrude from the housing 12 or be partly or wholly incorporated into the housing.

A peripheral unit such as a printer 32, equipped with a serial bi-directional or parallel input interface port, has plugged into it a similar inter-connecting device 12.

Each device 12 derives the power it requires for operation from the computer or peripheral unit into which it is plugged.

When data transmission is called for, usually by the computer 10, a radio link is established with the peripheral unit 32 via the two radio transceivers 28 and the data is then transmitted by so-called "ping-pong" transfer, in blocks with added checksums, generally as hereinbefore described.

Data transfer is accomplished accurately and efficiently and substantially as quickly as is the case with a conventional connector lead, but the connecting cable disadvantageously trailing between the computer 10 and the peripheral unit 32 is no longer necessary.

As shown in Figure 3 each of the devices 12 may include an external telescopic antenna 30, which is either in addition to or in place of an internal antenna (not shown).

The inter-connecting devices are plugged in at the rear of the computer 10 and printer 32, and the external antennae 30 and 31 are adjustable to overcome the problems of high

- 10 -

electrical noise and radio frequency shadowing, which can occur at the rear of such equipment.

As shown in Figure 5, the telescopic external antenna 31 is of a type which can also be swivelled on its mounting 40 so as to be adjustable to extend in a chosen orientation.

The housing 12 may include a channel 15 into which the antenna when telescoped can be folded. In the alternative, the antenna may be retracted into the housing.

This facility for length and orientation adjustment enables signal transmission and reception to be maximised, to which end a signal strength measuring circuit and indicator including for example an LED display 42 (see Figure 4), may be provided. The display 42 is conveniently viewable from outside of the housing.

The device 12 may be constructed as a two part housing, as shown in Figures 6 and 7 one part 46 hingedly joined to a second part 48 - the latter being adapted to engage into the computer interface port in a conventional manner. The housing 46 accommodates the printed circuit board carrying a processor and associated configuration memory 18, interface input/output circuit 20 with associated serial parallel selection switch 22, data packetisation and error handling circuit 24, channel set-up and data flow control circuit 26, short range radio transceiver circuit 28 of the FDMA type and an antenna (not shown) which in this example is wholly contained within the housing 46.

A peripheral unit such as a printer 32, also equipped with

- 11 -

a serial bi-directional or parallel input interface port, has plugged into it a small inter-connecting device.

The protrusion of the inter-connecting device from the rear of the computer 10 or peripheral unit 32, is minimised by forming it from the two hinged parts 46, 48, as best shown in Figure 7. The minor part 48 includes a Canon-D type or Centronics connector 16 for plugging into an interface port on the computer or peripheral unit.

As shown in Figure 1, the major part 46 of the hinged housing can be folded back substantially flat against the computer or peripheral unit, in order to reduce protrusion from the rear of the unit.

CLAIMS

1. A method of inter-connecting a computer and a peripheral unit each equipped with interface ports, for transferring data therebetween, wherein inter-connection is established by means of two connector plugs on the respective interfacing ports, characterised in that each plug is incorporated in a housing which also accommodates a short range radio transceiver adapted to receive and transmit signals from and to the other to establish a data highway between the computer and the peripheral unit.
2. A method as claimed in claim 1, characterised in that the inter-connection device derives the power required for operation through the pins of the connector plug which cooperate with the interface port of the computer or peripheral unit.
3. A method as claimed in claim 1, in which the inter-connection device incorporates a processor and an associated configuration memory and the method is further characterised by the additional step of capturing and storing information relating to the configuration and use of the device in the memory.
4. A method as claimed in claim 1, characterised in that each inter-connection device in the transmission mode, splits the data into blocks and for each block a check sum is computed and transmitted after the transmission of each datablock has been completed.

- 13 -

5. An inter-connection device for connecting to the interface ports of computing unit and computer peripheral units therefor, for transferring data therebetween characterised by a housing incorporating a plug for insertion into the interface port and a short range radio transceiver, adapted to receive and transmit signals from and to another such device also plugged into an interface port of another unit to establish a data highway between the two devices and therefore between a computing unit and a peripheral unit into which the two devices are plugged.

6. An inter-connection device as claimed in claim 5, further characterised by an external telescopic antenna having an adjustable mounting to permit the antenna to extend in a chosen orientation relative to the housing of the inter-connecting device.

7. An inter-connection device as claimed in claim 5, characterised in that the transceiver has associated therewith a signal strength indicator for indicating the received radio signal strength.

8. An inter-connection device as claimed in claim 5, characterised in that the housing is in two parts, one part comprising the connector plug and the other part accommodating the transceiver, wherein the two said parts are relatively hingeable to permit the larger part to be hinged from an in-line position in which there is maximum protrusion from a unit into which it is plugged into an L-formation with the major housing part folded substantially flat against the unit housing to thereby reduce the protrusion therefrom.

9. An inter-connection device as claimed in claim 8,



- 14 -

wherein the two housing parts are capable of hinging relatively through 180°.

10. A method of inter-connecting a computer and peripheral unit therefor, substantially as herein described with reference to and as shown in the accompanying drawings.

11. Inter-connection devices constructed and adapted to operate substantially as herein described with reference to and as shown in the accompanying drawings.

1/4

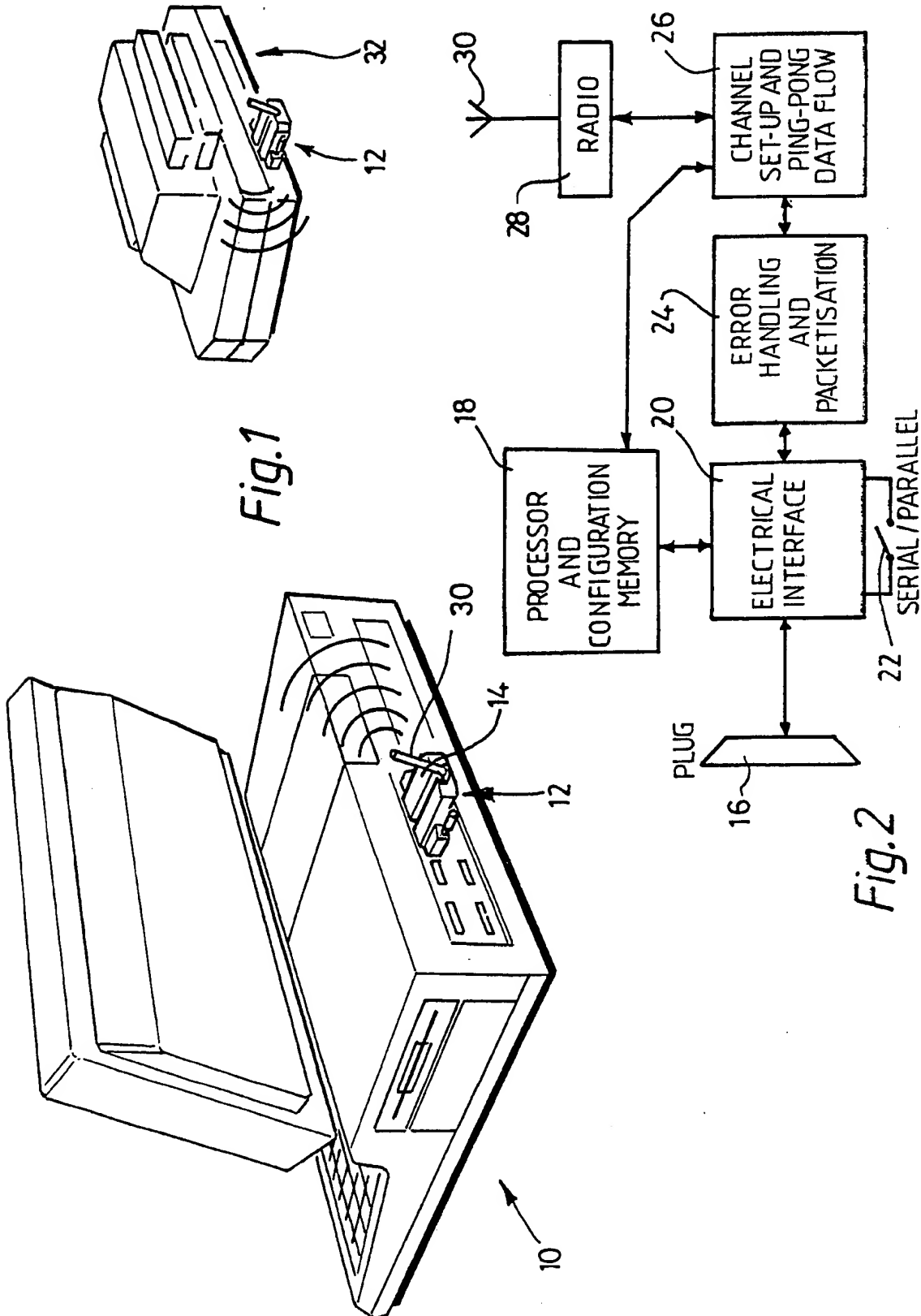


Fig.1

Fig.2

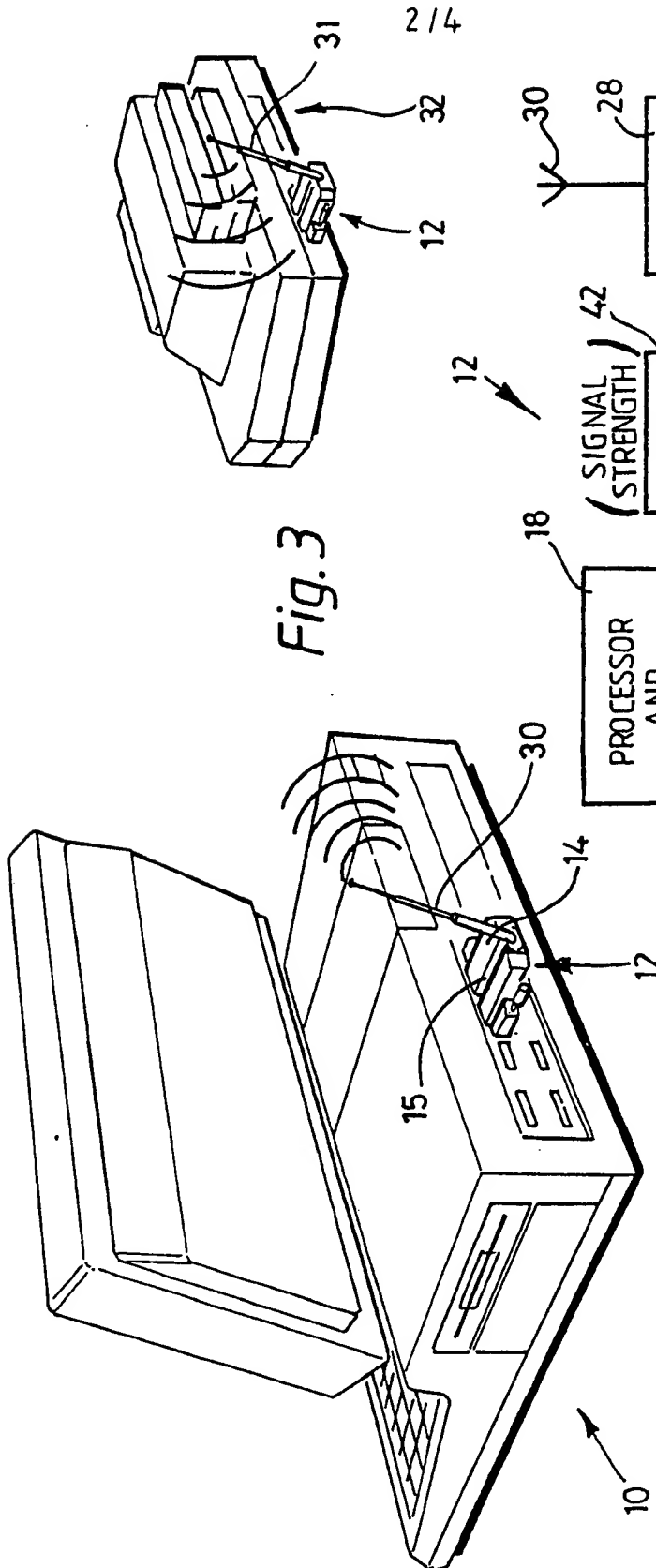


Fig. 3

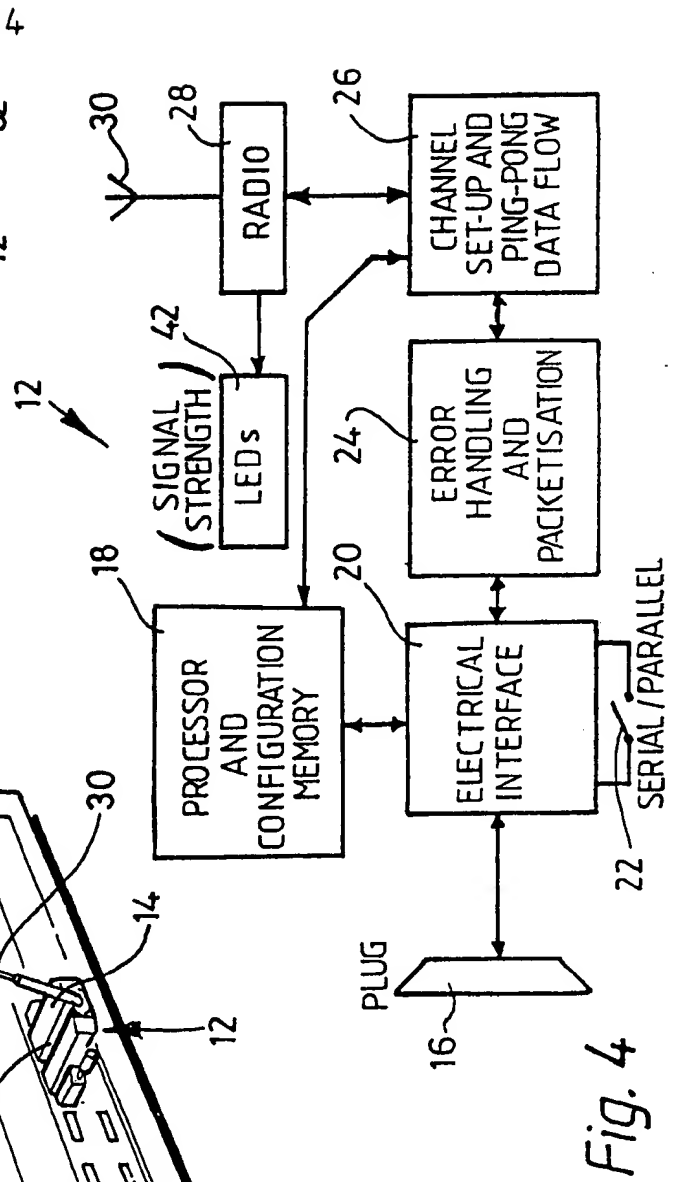
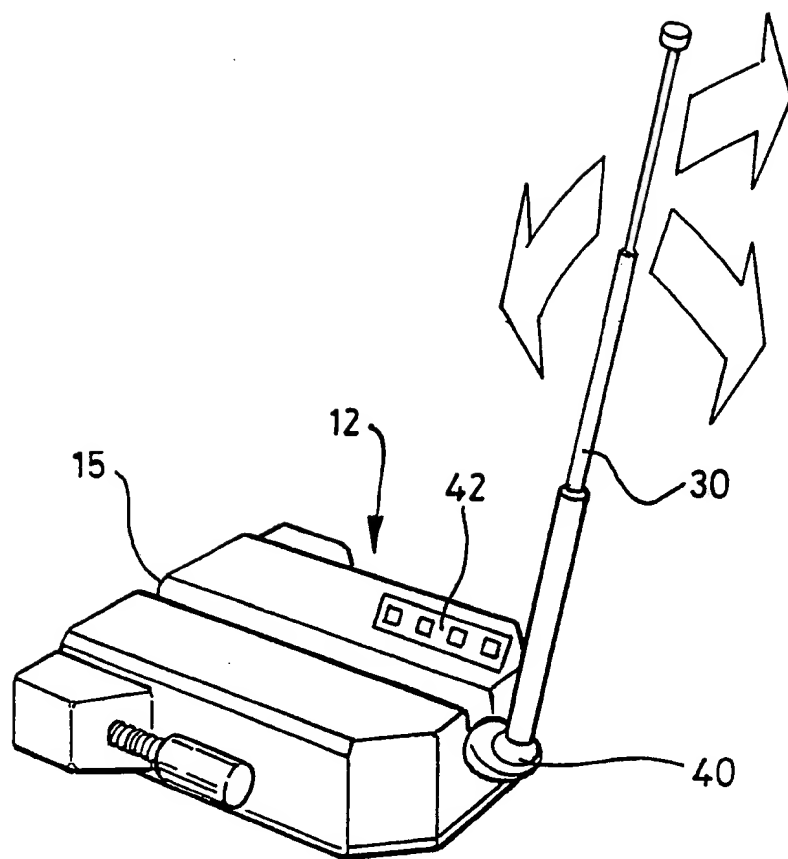


Fig. 4

3/4

*Fig. 5*

4 / 4

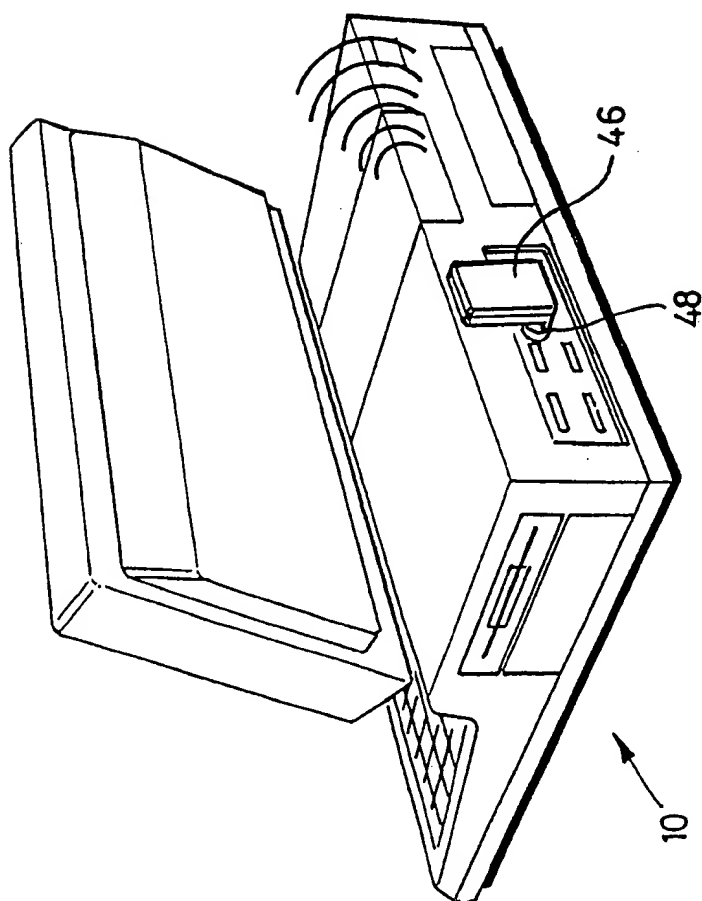


Fig. 6

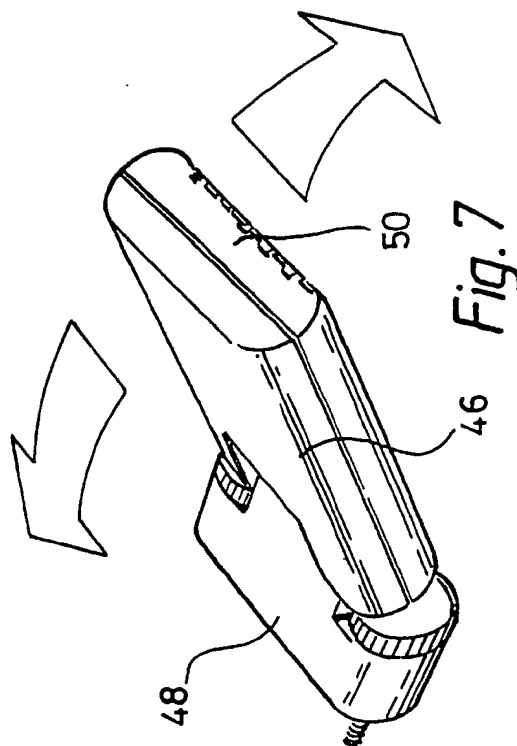
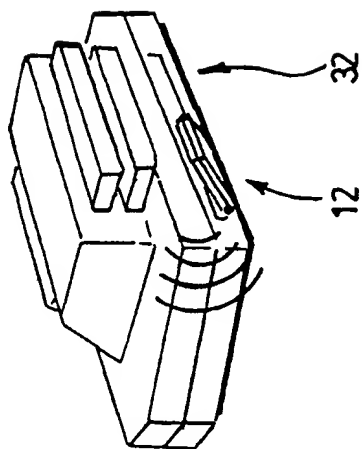


Fig. 7

# INTERNATIONAL SEARCH REPORT

International Application No. **PCT/GB 90/00652**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC<sup>5</sup>: G 06 F 13/40</b>																							
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; margin-top: 10px;">Minimum Documentation Searched *</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Classification System  </td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; padding: 5px;"><b>IPC<sup>5</sup></b></td> <td style="border: none; padding: 5px;"><b>G 06 F 13/40</b></td> </tr> </table> <div style="text-align: center; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *</div>			Classification System	Classification Symbols	<b>IPC<sup>5</sup></b>	<b>G 06 F 13/40</b>																	
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 60%;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 30%;">Relevant to Claim No. <sup>13</sup></th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td style="vertical-align: top;"> <b>US, A, 4247908 (LOCKHART, Jr. et al.)</b>            27 January 1981            see column 2, line 52 - column 3, line 11; column 3, lines 27-34; column 3, line 53 - column 4, line 8; column 4, line 65; column 5, lines 32-35; figure 10         </td> <td style="vertical-align: top;">1,3-5,10,11</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="text-align: center; vertical-align: top;">--</td> <td style="vertical-align: top;">6,7</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td style="vertical-align: top;"> <b>Patent Abstracts of Japan, vol. 10,</b>            no. 110 (P-450)(2167), 24 April 1986,            &amp; JP, A, 60239859 (NIPPON DENKI K.K.)            28 November 1985            see the abstract         </td> <td style="vertical-align: top;">1,5,10,11</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="text-align: center; vertical-align: top;">--</td> <td style="vertical-align: top;">2</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="vertical-align: top;"> <b>US, A, 4680788 (CORDEIRO et al.)</b>            14 July 1987            see column 5, lines 33-50; figure 2         </td> <td style="vertical-align: top;">8,9</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="vertical-align: top;"> <b>FR, A, 2139386 (SIEMENS AG)</b>            5 January 1973            see page 1, lines 22-26; figure 7         </td> <td style="vertical-align: top;">./.</td> </tr> </tbody> </table>			Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	X	<b>US, A, 4247908 (LOCKHART, Jr. et al.)</b> 27 January 1981 see column 2, line 52 - column 3, line 11; column 3, lines 27-34; column 3, line 53 - column 4, line 8; column 4, line 65; column 5, lines 32-35; figure 10	1,3-5,10,11	A	--	6,7	X	<b>Patent Abstracts of Japan, vol. 10,</b> no. 110 (P-450)(2167), 24 April 1986, & JP, A, 60239859 (NIPPON DENKI K.K.) 28 November 1985 see the abstract	1,5,10,11	A	--	2	A	<b>US, A, 4680788 (CORDEIRO et al.)</b> 14 July 1987 see column 5, lines 33-50; figure 2	8,9	A	<b>FR, A, 2139386 (SIEMENS AG)</b> 5 January 1973 see page 1, lines 22-26; figure 7	./.
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A	<b>FR, A, 2139386 (SIEMENS AG)</b> 5 January 1973 see page 1, lines 22-26; figure 7	./.																					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																							
<b>IV. CERTIFICATION</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">           Date of the Actual Completion of the International Search  <div style="text-align: center; margin-top: 10px;"><b>26th June 1990</b></div> </td> <td style="width: 50%; padding: 5px;">           Date of Mailing of this International Search Report  <div style="text-align: center; margin-top: 10px;"><b>18. 07. 90</b></div> </td> </tr> <tr> <td style="width: 50%; padding: 5px;">           International Searching Authority  <div style="text-align: center; margin-top: 10px;"><b>EUROPEAN PATENT OFFICE</b></div> </td> <td style="width: 50%; padding: 5px;">           Signature of Authorized Officer  <div style="text-align: center; margin-top: 10px;">   <b>H. DANIELS</b> </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center; margin-top: 10px;"><b>26th June 1990</b></div>	Date of Mailing of this International Search Report <div style="text-align: center; margin-top: 10px;"><b>18. 07. 90</b></div>	International Searching Authority <div style="text-align: center; margin-top: 10px;"><b>EUROPEAN PATENT OFFICE</b></div>	Signature of Authorized Officer <div style="text-align: center; margin-top: 10px;">   <b>H. DANIELS</b> </div>																	
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	DE, A, 507330 (RECKMANN G.) 8 October 1931 see lines 1-12, 38-30 --	8, 9
A	US, A, 4199809 (PASAHOW et al.) 22 April 1980 --	
A	FR, A, 2589598 (WESTINGHOUSE ELECTRIC CORP.) 7 May 1987 -----	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9000652  
SA 36553

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 06/07/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4247908	27-01-81	CA-A- 1131316	07-09-82
US-A- 4680788	14-07-87	None	
FR-A- 2139386	05-01-73	None	
DE-A- 507330		None	
US-A- 4199809	22-04-80	None	
FR-A- 2589598	07-05-87	US-A- 4775928	04-10-88
		JP-A- 62106530	18-05-87